Name: _____

Physics 103 Elementary Physics I

First Examination: Wednesday 27 September 2023, 10:00 AM–10:50 AM

- This exam consists of **four** problems, each of which is worth **ten** points, and you have **fifty minutes** in which to work them. (I find the last two problems more difficult than the first two, but each problem is worth the same number of points.)
- You may not discuss the exam with anyone other than me. If you find a problem statement unclear, visit me in the hallway immediately outside of the lecture hall.
- You may consult one $8\frac{1}{2}$ by 11 inch page of your own notes, but no other material. Calculators are permitted, collaboration is not.
- Solutions must be complete enough that I can follow the logic. Use the English language when appropriate.
- If you need extra paper or scrap paper you may obtain it from the stock at the front desk. Staple all extra pages that you use (including scrap pages) to this exam when you hand it in.
- Adhere to the requirements of the honor system. Sign the honor pledge below.

Dan Styer

I have adhered to the Honor Code in this assignment.

_____

	points earned	maximum
problem 1		10
problem 2		10
problem 3		10
problem 4		10
total		40

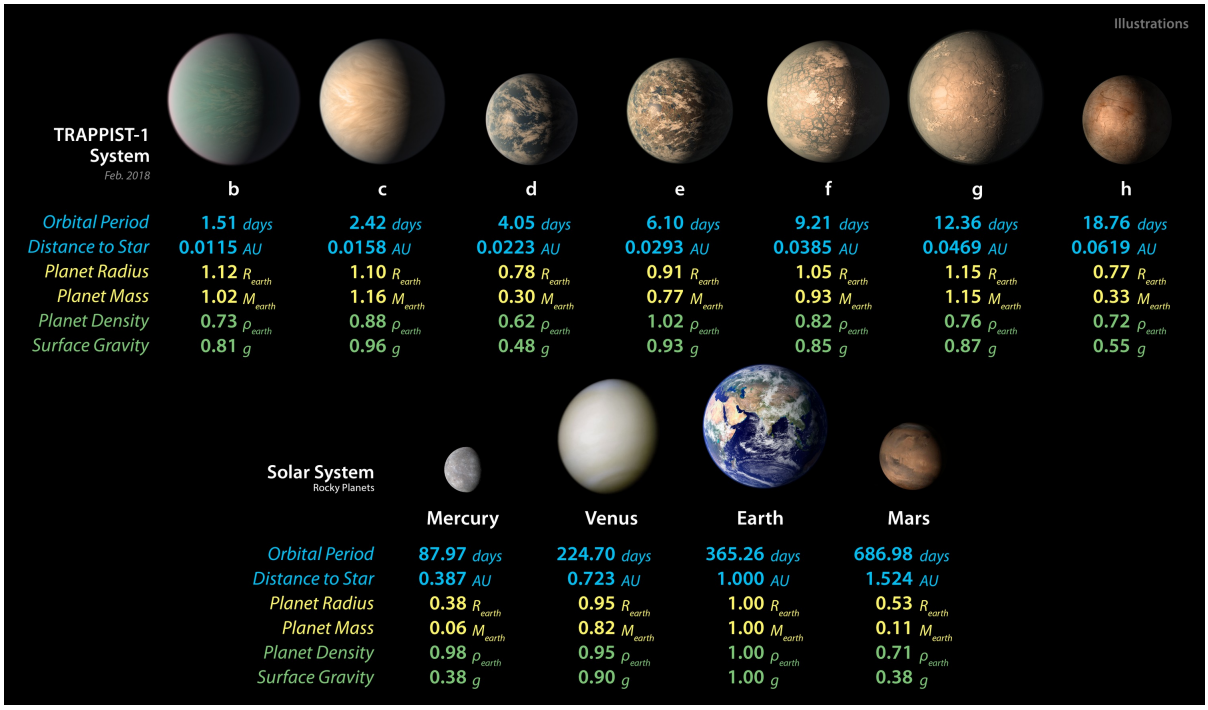
Note well! In all the problems in this exam:

- I expect you to use significant figures.
- Take $g = 9.807$ m/s^2 (appropriately rounded).

1. *Runaway truck.*
An out-of-control truck enters a 118 m long runaway truck ramp at speed 26.6 m/s. What is the minimum constant acceleration the truck must experience to stop on the ramp?

2. *Lost in space.*

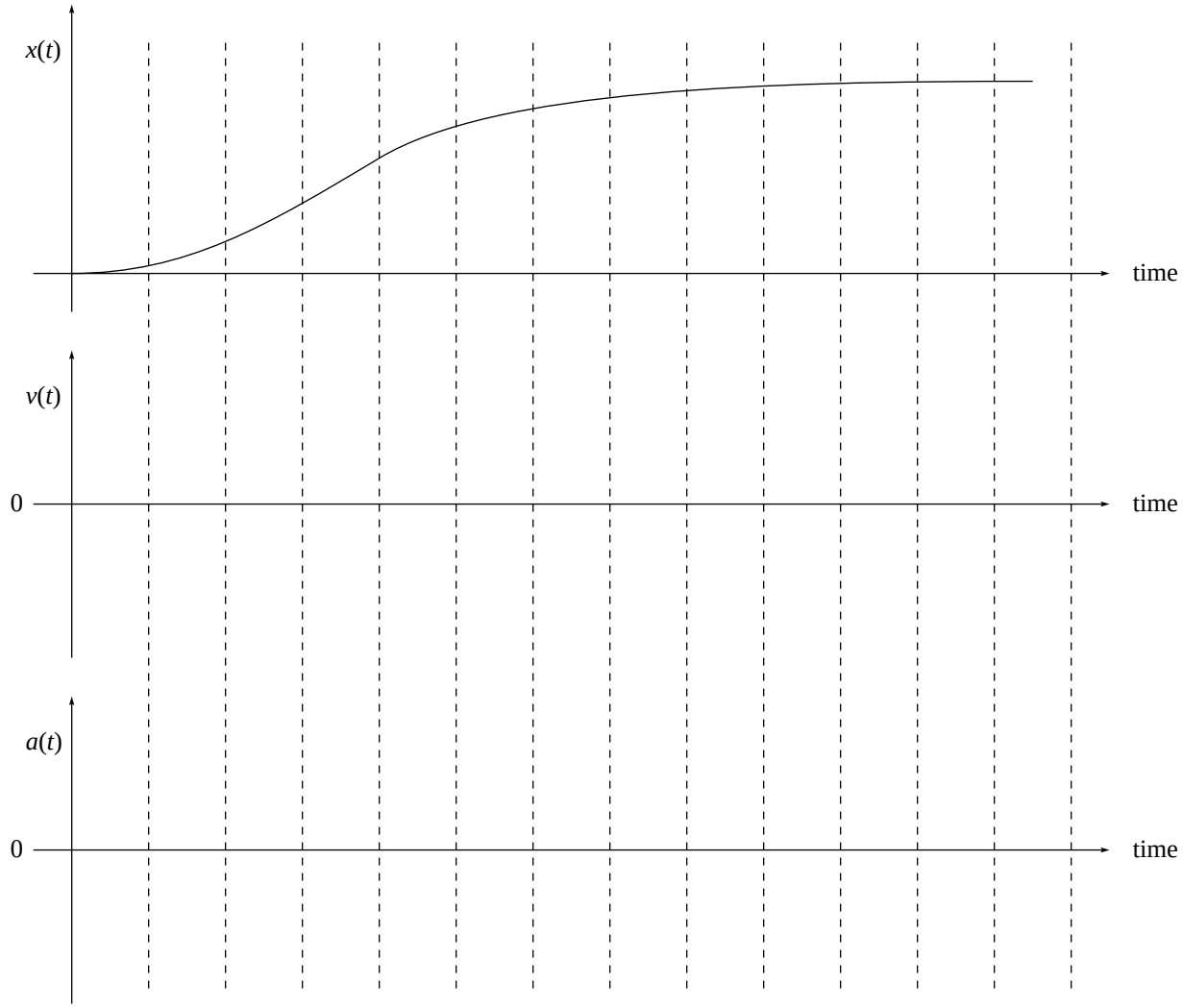
You are on an interstellar space mission to the seven-planet system TRAPPIST-1, located 40 light-years from Earth. Unfortunately your navigation system malfunctions, so you land on one of the seven planets but you're not sure which one. You drop a pebble from a height of 1.8 m and find that it takes 0.87 s to reach the ground. Your boss at NASA has given you this information card:



Which planet are you on?

3. *Rocket-propelled sled.*

A rocket-propelled sled starts from rest, speeds down a track, runs out of fuel and then slides to a halt (due to friction). The graph below shows its position as a function of time. Sketch the velocity and the acceleration as functions of time in the space provided. Your two sketches should not be quantitatively precise, but they must be qualitatively appropriate (with, for example, slopes of the correct sign) and they must accurately locate important features such as zeros, maxima, and minima.



4. *Cliff drop.*

A pebble at rest drops from the top of a cliff. (Ignore forces from the air: wind gusts, drag, etc.) The time required to drop the first half of the cliff's height (t_h) is of course less than the time required to drop the entire height of the cliff (t_e), but how much less? Is it half, three-quarters, one-quarter, or something else? Find the ratio t_h/t_e.